

Patent claims

1. An injection device for a syringe, having a
5 syringe body, a cannula with a needle, a plunger
with a plunger rod, and an injection carriage for
displacing the syringe body and the plunger, and
having at least one actuating element that acts on
the injection carriage to carry out the injection
10 procedure, characterized in that the actuating
element (120, 220, 320) cooperates with components
which withdraw the needle (108, 208, 308) from the
puncture site once the injection procedure has
been completed, using a return stroke (H3) that is
15 applied to the injection carriage.
2. The injection device as claimed in claim 1,
characterized in that the injection procedure
includes an insertion stroke (H1), and in that the
20 return stroke (H3) substantially corresponds in
magnitude to the insertion stroke (H1) and,
compared to the latter, acts on the syringe in the
opposite direction.
- 25 3. The injection device as claimed in claim 1 and
claim 2, characterized in that the injection
procedure is formed by the insertion stroke (H1)
and by a subsequent injection stroke (H2) with
which the plunger (104, 204, 304) is displaced in
30 the syringe body (101, 201, 301) and the injection
liquid is injected.
4. The injection device as claimed in claims 1
through 3, characterized in that the injection
35 carriage includes a syringe holder (140, 240, 340)
in which the syringe body (101, 201, 301) is
mounted for the insertion stroke (H1), and a ram
(150, 250, 350) which can be displaced against the
syringe holder in order to act on the plunger rod

(105, 205, 305) for the injection stroke (H2).

5. The injection device as claimed in claim 4, characterized in that syringe holder (140, 240, 340) and ram (150, 250, 350) are coupled releasably to one another in such a way that they are acted on jointly by the actuating element in the insertion stroke (H1) and in such a way that only the ram (150, 250, 350) is acted upon in the injection stroke (H2).
6. The injection device as claimed in claim 1, characterized in that the actuating element is a push rod (120, 220) which is guided parallel to the injection carriage in a housing (110, 210) and by means of which, when it is pushed into the housing (110, 210), the components for producing the return stroke (H3) are also activated.
7. The injection device as claimed in claim 6, characterized in that the components for producing the return stroke (H3) include at least one toothed wheel (113) which engages in the injection carriage (140, 150) and in the push rod (120) and which is mounted in a carriage (114A) displaceable in the housing (110), and in that the toothed wheel (113) cooperates with a blocking element which blocks the toothed wheel (113), when insertion stroke (H1) and injection stroke (H2) are performed, and which thereafter releases the toothed wheel (113), as a result of which the linear movement of the push rod (120) is converted into the oppositely directed return stroke (H3) of the injection carriage (140, 150).
8. The injection device as claimed in claim 7, characterized in that at least two toothed wheels (113A, 113B) for converting the linear movement of the push rod (120) into the return stroke (H3) are

provided in the common carriage (114A).

9. The injection device as claimed in claim 7,
characterized in that the blocking element is a
5 pawl (114) which is linearly displaceable on the
carriage (114A) and which, in the blocking
position, engages in the teeth of the toothed
wheel (113).
- 10 10. The injection device as claimed in claim 7,
characterized in that the blocking element is a
pivot lever (114B) which, in the blocking
position, engages in the teeth of the push rod
(120).
- 15 11. The injection device as claimed in claims 3
through 6, characterized in that the coupling
between syringe holder (140) and ram (150) is
effected by two slide blocks (145A, 145B) which
20 can be brought into a releasable positive
engagement between syringe holder (140) and
housing (110), and between syringe holder (140)
and ram (150).
- 25 12. The injection device as claimed in claims 3
through 7, characterized in that the coupling
between syringe holder (140) and ram (150) is
effected by a further toothed wheel (113C) which
is likewise held in the carriage (114A) and which
30 is blocked during the insertion stroke (H1).
13. The injection device as claimed in claim 6,
characterized in that the components for producing
the return stroke (H3) include at least one spring
35 element (261A, 261B) as energy accumulator which,
before the start of the injection, is pretensioned
by the push rod (220) (tensioning stroke) and,
after the injection stroke (H2), is released, in
order to produce the return stroke (H3) by acting

abruptly on a return carriage (260) which is releasably connected to the injection carriage and which bears on the syringe holder (240).

5 14. The injection device as claimed in claim 13, characterized in that a rotatably mounted control lever (221) is provided in the push rod (220), one end of this control lever (221) engaging in the injection carriage (240, 250) when the tensioning
10 stroke has been completed.

15 15. The injection device as claimed in claim 14, characterized in that the control lever (221), by turning about a control angle, also effects the release of the coupling between syringe holder (240) and ram (250) at the transition from the insertion stroke (H1) to the injection stroke (H2).

20 16. The injection device as claimed in claim 13, characterized in that the return carriage (260) has pincer-like locking elements (262A, 262B) which, after the injection stroke (H2), engage in recesses (226A, 226B) of the push rod (220) and
25 release the return stroke (H3).

30 17. The injection device as claimed in claim 1, characterized in that the actuating element includes a pull-out loading bar (320) which, when pulled out from the housing (310), pretensions at least one advancer spring (324) as energy accumulator, and a trigger mechanism (370) which, after activation, releases the injection carriage (340, 350) acted upon by the advancer spring (324)
35 via an advancer carriage (323) for automatic execution of insertion stroke (H1), injection stroke (H2) and return stroke (H3).

18. The injection device as claimed in claim 17,

characterized in that the pull-out loading bar (320), after it has been pulled out from the housing (310), pretensions at least one restoring spring (325) as energy accumulator for automatic
5 return of the pull-out loading bar (320).

19. The injection device as claimed in claim 17, characterized in that the advancer spring (324) and the restoring springs (325) are scroll
10 springs.

20. The injection device as claimed in claim 17, characterized in that the trigger mechanism (370) is coupled to at least one safety element (371)
15 which in particular permits triggering only when the injection device is placed on the insertion site.

21. The injection device as claimed in claim 17, characterized in that pull-out loading bar (320),
20 advancer springs (324, 325), injection carriage (340, 350) and advancer carriage (323) are held in a receiving frame (312) in such a way that they can be displaced parallel to one another.

25 22. The injection device as claimed in one of the preceding claims, characterized in that, in order to control the processes, in particular the sequence of insertion stroke (H1), injection
30 stroke (H2) and return stroke (H3), control elements that can be brought into and out of positive/frictional engagement with one another are provided, in particular on the actuating
element (120, 220, 320), on the syringe holder
35 (140, 240, 340), on the ram (150, 250, 350) and on the housing (110, 210) or receiving frame (312).

23. The injection device as claimed in claim 21, characterized in that the control elements include

number of pull rollers (420D) only to a fraction of the spring force of the restoring spring (425) (first pulley block).

5 28. The injection device as claimed in claims 24
through 27, characterized in that the advancer
spring (424) is connected to the receiving frame
(412) via a traction wire (424B) which is guided
over at least one pull roller (424D) on whose
10 shaft the other end of the advancer spring (424)
is held, so that the tensile force applied by the
advancer spring (424) to the traction wire (424B)
and thus to the advancer carriage (424D) is only a
fraction of the spring force of the advancer
15 spring (424) (second pulley block).

29. The injection device as claimed in claim 1,
characterized in that a damping unit (492) is
assigned to the actuating element and/or to the
20 injection carriage (440, 450).

30. The injection device as claimed in claim 1,
characterized in that additional components are
provided which produce a time delay (TV) between
25 the completion of the injection procedure and the
start of the return stroke (H3).

31. The injection device as claimed in claim 30,
characterized in that the additional components
30 cancel the frictional coupling between ram (450)
and advancer carriage (423) as the advancer
carriage (423) continues to move for the duration
of the time delay (TV).

32. The injection device as claimed in claim 31,
characterized in that the duration of the time
35 delay (TV) is adjustable.

33. The injection device as claimed in claims 1 and 4,

characterized in that a volume adapter (410) can be inserted into the ram (450) and predetermines the injection stroke (H2) and thus the quantity of a medicament that is administered during the injection stroke (H2).

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34. The injection device as claimed in claims 7, 24 and 30, characterized in that at least two toothed wheels mounted in the carriage (414, 415) and belonging to a pair of toothed wheels (413, 513) for gearing up or gearing down between the linear movement of the carriage (414, 514) and of the advancer carriage (423) are provided, on which at least one spring element engages for producing the strokes (H1, H2, H3) and the time delay (TV).

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35. The injection device as claimed in claim 34, characterized in that the advancer carriage (423) is formed by a toothed belt (523).

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